**What Every Principal and School Leader Needs to Know About the Teaching and Learning of Mathematics**

**Dr. Timothy D. Kanold (tkanold.blogspot.com)**

*“These standards are not intended to be new names for old ways of doing business. They are a call to take the next step. It is time for states to work together to build on lessons learned from two decades of standards-based reforms. It is time to recognize that standards are not just promises to our children, but promises we intend to keep.”*

*—Common Core State Standards Initiative (2010), p.5*

One of the greatest problems with mathematics instruction, and instruction in general in most school districts, is that it is too inconsistent from classroom to classroom, school to school, and district to district (Morris & Hiebert, 2011). How much mathematics a fourth-, eighth-, or tenth-grade student in the United States learns, and how deeply he or she learns it, is largely determined by the school the student attends, and even more significantly, the teacher the student is randomly (usually) assigned to within that school. The inconsistencies teachers develop in their professional development practice—often random and in isolation from other teachers—create great inequities in students’ mathematics instructional and assessment learning experiences that ultimately and significantly contribute to the year-by-year achievement gap (Ferrini-Mundy, Graham, Johnson, & Mills, 1998).

The Education Trust (Ushomirsky & Hall, 2010, p.10), in *Stuck Schools: A Framework for Identifying Schools Where Students Need Change—Now,* indicates that in an environment where funds and capacity are limited at best, educators and policymakers will need to establish clear priorities for teachers and students. It is time to embrace a vision for behaviors that will address those priorities.

**Five fundamental paradigm shifts for mathematics: Knowing what to disturb**

The CCSS for mathematics expectations for teaching and learning, and the new Common Core state assessments of that learning, usher in an opportunity for unprecedented change of the *second-order* variety. First-order change is characterized as working within existing paradigms with marginal disturbance to the system, and is implemented within the existing knowledge and skill set of those closest to the action—the faculty and school leaders. Second-order change requires working outside existing paradigms by embracing new paradigms for how you *think and practice* (Waters, Marzano, & McNulty, 2003*,* pp. 6–7).

Until now, there has been a lot of debate and policy discussion, but no clear turning point with respect to the focus of K–12 mathematics education improvement. The CCSS for mathematics represent a collective and collaborative states’ effort to signal that turning point. It is time to disturb the system as currently defined. And the CCSS provide the catalyst for that disturbance.

There are five fundamental second-order paradigm shifts (outside of existing paradigms) required to prepare every student and teacher for the successful implementation of the CCSS in mathematics and for the general improvement of mathematics learning for K–12 students in the United States. They are:

1. **Professional Development**—The CCSS for mathematics require a paradigm shift to move the *grain size of change* beyond the individual, isolated teacher or leader. It is the grade-level or course-based collaborative learning team (collaborative team) within a PLC that will develop the expanded teacher knowledge capacity and teacher support necessary for successful implementation of the CCSS for mathematics. Your leadership role is to provide the conditions, structures, and the culture necessary to eradicate the old paradigm of isolated teacher decision-making and accidental professional development and growth.
2. **Mathematics Instruction: teaching and learning**—The CCSS require a paradigm shift to daily lesson designs that include plans for accommodating the student *Mathematical Practices* described in the CCSS. These student practices focus on the process of student learning and student development of deeper understanding of mathematics. This paradigm shift requires teaching for procedural fluency *and* student understanding of the grade level CCSS content and using student understanding as a precursor to procedural fluency. Procedural fluency and conceptual understanding should not and cannot exist without one another (Kilpatrick, Swafford, & Findell, 2001).
3. **Mathematics Content**—The CCSS require a paradigm shift to “*less* (fewer standards) is *more* (deeper rigor with understanding)” at every grade level. This will require new levels of knowledge and skill development for every K–12 teacher of mathematics to understand *what* the CCSS expect students to learnblended with *how* students learn it. What mathematical knowledge, skills, understandings, and dispositions should be the result of each unit of mathematics instruction? To support teacher success there needs to be great clarity and low teacher-to-teacher variance on the question, *“Learn what and learn how?”*
4. **Mathematics Assessment**—The CCSS require a paradigm shift toward assessment as a multifaceted process that reflects the rigor of the standards and models the expectations for and benefits of *formative assessment* development around all forms of assessment, including traditional assessment instruments such as tests and quizzes. *How you will know* if each student is learning the essential mathematics skills, concepts, understandings, and dispositions the CCSS deem most essential, becomes a significant question for each collaborative team.
5. **Mathematics Intervention**—The CCSS require a paradigm shift toward a team and school response to intervention (RTI) that is *required*, coherent and collaboratively shared. RTI can no longer be invitational. That is, the RTI needs to become R2TI—a “required” response to intervention. Stakeholder implementation of RTI programs includes a process that *requires* targeted students to participate and attend. How will you *respond* and act on evidence (or lack of evidence) of student learning in your school or district?

**Key CCSS Web Resources**

1. The Center on Education Policy (cep-dc.org/)
2. PARCC Consortium (parcconline.org/)
3. The Common Core State Standards documents in Mathematics and ELA (corestandards.org/)
4. The Hunt Institute Mathematics (youtube.com/user/TheHuntInstitute#p/u/14/BNP5MdDDFPY)
5. Myths and facts about the CCSS (ped.state.nm.us/CCS/plan/read/CoreFacts.pdf)
6. SMARTer Balanced resources and Frameworks (www.k12.wa.us/SMARTER/default.aspx)

**Other Resources for Mathematics (as of March 2012)**

1. **For principals**

insidemathematics.org/index.php/tools-for-teachers/tools-for-principals-and-administrators

This portion of the Inside Mathematics website is designed to support school-based administrators and district mathematics supervisors who have the responsibility for establishing the structure and vision for the work of grade-level and cross-grade-level learning teams.

*What Every Principal Needs to Know About the Teaching and Learning of Mathematics* (Kanold, Briars, & Fennel, 2012, Solution Tree)

1. **Common Core Standards for Mathematical Practice (Inside Mathematics)**

insidemathematics.org/index.php/common-core-standards

This site provides classroom videos and lesson samples designed to illustrate the Mathematical Practices in action.

1. **Common Core Mathematical in a PLC at Work™**

**professional development book series (Solution Tree/NCTM, 2012)**

<http://www.solution-tree.com/products/books/common-core-mathematics>

This series (Kanold, et al) provides unit-by-unit professional development support and guidance for implementation of the Common Core.

1. **NCTM lessons**

illuminations.nctm.org/

**Illuminations** provides standard-based resources that improve the teaching and learning of mathematics for all students. These materials illuminate the vision for school mathematics set forth in *Principles and Standards for School Mathematics,* Curriculum Focal Points for Prekindergarten through Grade 8 Mathematics, and Focus in High School Mathematics: Reasoning and Sense Making.

1. **Common Core State Standards blog**

commoncoretools.wordpress.com/

**Follow Bill** McCallum**’s blog on tools that are being developed to support the implementation of the CCSS.**

1. **CCSS Mathematics Curriculum Materials Analysis Project (Council of Chief State School Officers, The Brookhill Foundation, and Texas Instruments)**

mathedleadership.org/docs/ccss/CCSSO%20Mathematics%20Curriculum%20Analysis%20Project.Whole%20Document.6.1.11.Final.docx

The CCSS Mathematics Curriculum Analysis Project provides a set of tools to assist K–12 textbook selection committees, school administrators, and teachers in the analysis and selection of curriculum materials that support implementation of the CCSS for mathematics.

1. **Illustrative Math Project (Institute for Mathematics and Education)**

illustrativemathematics.org

The main goal for this project is to provide guidance to states, assessment consortia, testing companies, and curriculum developers by illustrating the range and types of mathematical work that students will experience in implementing the Common Core State Standards for mathematics.

# Progressions documents for the Common Core Math Standards (Institute for Mathematics and Education)

ime.math.arizona.edu/progressions

The CCSS in mathematics were built on progressions: narrative documents describing the progression of a topic across a number of grade levels, informed both by research on children's cognitive development and by the logical structure of mathematics. The progressions detail why standards are sequenced the way they are, point out cognitive difficulties and provide pedagogical solutions, and provide more detail on particularly difficult areas of mathematics.